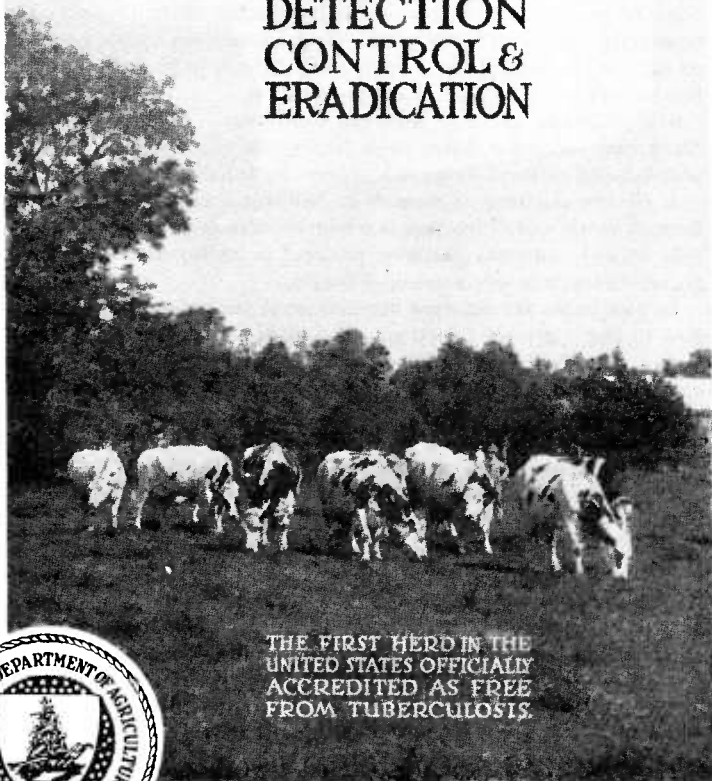


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U. S. DEPARTMENT OF  
AGRICULTURE  
FARMERS' BULLETIN No. 1069

TUBERCULOSIS  
IN LIVE STOCK  
DETECTION  
CONTROL &  
ERADICATION



THE FIRST HERD IN THE  
UNITED STATES OFFICIALLY  
ACCREDITED AS FREE  
FROM TUBERCULOSIS.



## HOW TUBERCULOSIS SPREADS FROM A DISEASED HERD TO A HEALTHY ONE

**T**UBERCULOSIS may be introduced into a healthy herd by any of the following means:

1. By the addition of an animal that is affected with the disease. Therefore animals should be purchased only from herds known to be free from tuberculosis, or from herds under supervision for the eradication of the disease.

2. By feeding calves with raw milk or other dairy products from tuberculous cows. This frequently occurs where the owner purchases mixed skim milk from the creamery and feeds it to his calves without first making it safe by boiling or pasteurization.

3. By showing cattle at fairs and exhibitions. Reports have indicated that numerous herds have become infected through mingling with infected cattle at shows or by occupying infected premises.

4. By the shipment of animals in cars which have recently carried diseased cattle and which have not been disinfected properly.

5. From community pastures; pastures in which tuberculous cattle are allowed to graze are a source of danger.

In most cases the outward appearance of the animal bears no relation to the degree of infection. The disease frequently develops so slowly that in some cases it may be months or even longer before any symptoms are shown; therefore be on the safe side and have your herd tested.

Tuberculosis eradication is a cooperative work of the Bureau of Animal Industry of the United States Department of Agriculture, the livestock sanitary officials of the various States, and individual cattle owners.

# TUBERCULOSIS IN LIVESTOCK

## DETECTION, CONTROL, AND ERADICATION<sup>1</sup>

By ALEXANDER E. WIGHT, *Chief, Tuberculosis Eradication Division, Bureau of Animal Industry*

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### PRESENT KNOWLEDGE OF TUBERCULOSIS

**P**ROBABLY no disease affecting either the human race or livestock is better known or has been the object of so much study as tuberculosis. Knowledge of the disease is derived from many sources, including the work of eminent scientists who have studied the numerous ways in which it is spread, the manner by which man and animals contract it, and the effects it produces.

The tuberculin test—the means of detecting tuberculosis—was devised in 1890 by the eminent scientist, Robert Koch. Thus the test has been known for more than 48 years. The facts regarding it and other information presented in this bulletin are based on long experience and scientific evidence. The methods recommended to be used in the eradication of tuberculosis have been tried and found to be effectual and practicable.

### IMPORTANCE OF ERADICATION WORK

The elimination of bovine tuberculosis from a farm and surrounding territory gives a cattle owner numerous advantages, chief among which are increased prices received for surplus breeding cattle and the greater assurance that other livestock on the same farm will not contract tuberculosis. Another important consideration is that of human health. Many cases of tuberculosis among children are traceable to the use of milk from tuberculous cows. If milk is properly pasteurized the living organisms of tuberculosis are destroyed, but raw milk and milk improperly pasteurized may be sources of danger. Many cities and towns have ordinances requiring milk and other dairy products to come from herds that are free from tuberculosis.

<sup>1</sup> This is a revision of former editions by John A. Kiernan, formerly Chief of the Division, and Dr. Wight. Dr. Kiernan died in 1927.

### TUBERCULOSIS A DECEPTIVE DISEASE

If tuberculosis were similar to foot-and-mouth disease in cattle, swine, and sheep, which causes rather spectacular symptoms, it would arouse immediate alarm among livestock owners, but because it is generally slow in developing and its symptoms commonly are not easily recognized from the general outward appearance of the animals (fig. 1), many people believe that it does comparatively little damage among livestock. Contrary to such opinions, however, the loss from tuberculosis was one of the heaviest taxes imposed upon our livestock industry, amounting, probably, to at least \$40,000,000 a year in the United States prior to the time when systematic eradication work was begun.



FIGURE 1.—Portion of a herd of 45 cattle showing no external symptoms of tuberculosis. On application of the tuberculin test, 37, or 82 percent of the animals, were found to be tuberculous. The germs of the disease may live for months in manure or litter.

### PREVALENCE OF TUBERCULOSIS

The tuberculin test was used to some extent in the United States soon after its discovery, and there was a gradual increase in its use until 1917, when the cooperative campaign was undertaken by the Federal Government and several of the States. During the early part of the campaign there was some tuberculosis in every State and Territory although the degree varied considerably. As the campaign progressed the extent of infection was reduced to less than 0.5 percent of the cattle population in county after county. These counties were designated as modified accredited areas and are considered to be practically free of bovine tuberculosis (fig. 2).

All States are now (1939) 100 percent modified accredited except California, which still has a few counties not in the modified accredited area. Puerto Rico and the Virgin Islands are in the modified accredited area. The late John A. Kiernan, former chief of the Tuberculosis Eradication Division of the Bureau of Animal Industry and coauthor of this bulletin in its original form, firmly believed that with full cooperation of State and local officials bovine tuberculosis could be eradicated from the United States. Similar predictions of State officials have already been realized.

In order to keep officials and other interested persons informed as to the progress of the campaign, the Department issues a monthly summary in mimeographed form showing the number of tests, number of modified accredited counties, and other information for each State. In addition to this the Department has made biennial Nation-wide surveys which determine the approximate percentage of infec-



FIGURE 2.—Part of a large herd of Hereford cattle in the range area of Texas. When this herd was tested there were no reactors. The entire country in which this herd ranges is now a modified accredited area.

tion in each county, State, and Territory. The results of 9 of these biennial surveys, shown below, indicate that infection has gradually decreased since eradication work got well under way.

Tuberculous cattle		Tuberculous cattle	
Year:	Percent	Year:	Percent
1922	4.0	1932	1.4
1924	3.3	1934	1.1
1926	2.8	1936	.5
1928	2.0	1938	.4
1930	1.7		

Tuberculosis is known to exist quite extensively among cattle and swine in European countries; in fact, no large part of the world is known to be absolutely free from it. There are, however, some restricted regions where its presence is not known or where it exists in but a very moderate degree.

Until cattle from the eastern part of the United States were introduced into the Middle Western, Western, and Southern States tuberculosis among livestock in those regions was unknown. The disease at that time was confined to the herds east of the Allegheny Mountains. It was known then that a considerable percentage of herds in those States were affected, but livestock owners were not inclined to consider tuberculosis as of very great economic importance or dangerous to human health. Therefore very little progress was made in its eradication. As the Central and Western States became settled and cattle were moved westward the disease spread much more rapidly than is generally realized. The spreading in those areas is due, of course, to the fact that the livestock industry occupies a more important part in agriculture than in the Eastern States. Cattle are traded in more extensively and are continually being shipped and trailed from State to State and from farm to farm.

In some localities in the West where dairying has developed extensively it is now known that carload lots of cows purchased in other States have contained 50 percent or more of tuberculous animals. Some herds of beef cattle in the West have become infected with the disease by having placed among them tuberculous purebred bulls and cows that came from diseased herds elsewhere. The importance of controlling tuberculosis and preventing its spread by the interstate movement of diseased animals was not so well recognized during the times of pioneer development as it is today. Consequently, in the absence of regulations and inspection, diseased animals moved from one State to another. The shipment of cattle from Eastern and Northern States to the South, with the exception of dairy herds near the larger cities, did not commence until progress had been made in the eradication of the cattle tick.

#### LOSSES OF MEAT FOOD PRODUCTS

Records kept by the Meat Inspection Division of the Bureau of Animal Industry indicate the great financial loss caused by tuberculosis every year. They also indicate how widespread tuberculosis in cattle and swine is in the United States, as the establishments in which the diseased animals were slaughtered are in all parts of the country. More than that, only about 65 percent of the cattle and swine, it is estimated, are slaughtered each year in establishments under Federal supervision, so that about 35 percent of these classes of animals slaughtered each year in the United States do not appear in these records. The losses shown in table 1 are therefore considerably less than the total loss for the entire country.

When animals are "retained" by the Federal inspectors on account of tuberculosis it means that some evidence of the disease is discovered and the carcass is put aside for further examination. If the disease is found to be so slight as to render the undiseased portion of the carcass fit for food, the diseased area is removed, and the remainder is passed. It will be noted that such is the case in most carcasses

TABLE 1.—Number of cattle (except known reactors) and swine slaughtered and those retained, condemned, and sterilized on account of tuberculosis, at establishments where Federal meat inspection is maintained, 1916–38

Fiscal year	Cattle						Swine					
	Slaugh-tered	Retained <sup>1</sup>		Condemned and sterilized		Slaugh-tered	Retained <sup>1</sup>		Condemned and sterilized			
		Number	Percent	Number	Percent		Number	Percent	Number	Percent		
	<i>Number</i>					<i>Number</i>						
1916.....	7,387,051	173,754	2.35	39,218	0.53	40,482,799	3,687,817	9.1	169,261	0.42		
1917.....	9,276,049	195,488	2.11	49,214	.53	40,210,847	3,978,168	9.9	168,350	.42		
1918.....	10,912,417	196,917	1.8	46,235	.42	35,449,247	3,494,587	9.9	148,655	.42		
1919.....	11,212,543	176,250	1.57	42,729	.38	44,398,389	4,103,376	9.2	165,638	.37		
1920.....	9,666,188	157,016	1.62	39,305	.41	38,981,914	4,260,719	10.9	159,873	.41		
1921.....	8,137,982	132,068	1.62	33,312	.41	37,702,866	4,693,305	12.4	161,064	.43		
1922.....	7,795,323	146,945	1.87	34,712	.45	39,416,439	5,640,081	14.3	166,113	.42		
1923.....	8,934,975	156,738	1.75	41,113	.46	48,600,069	7,139,925	14.7	202,490	.42		
1924.....	9,049,342	141,595	1.56	39,333	.43	54,416,481	8,293,965	15.2	225,110	.41		
1925.....	9,595,969	145,012	1.51	40,374	.42	48,459,608	7,039,724	14.5	192,610	.4		
1926.....	9,817,599	138,506	1.41	41,125	.42	40,442,730	5,667,093	14	145,394	.36		
1927.....	9,810,797	112,924	1.15	31,755	.32	42,650,443	5,778,009	13.6	132,888	.31		
1928.....	8,837,882	91,856	1.04	25,664	.29	48,347,393	5,872,503	12.1	125,505	.26		
1929.....	8,120,992	81,276	1.0	21,265	.26	47,163,573	5,408,910	11.5	104,654	.22		
1930.....	8,119,760	61,192	.75	15,487	.19	46,688,860	5,321,352	11.4	96,164	.2		
1931.....	8,061,749	50,725	.63	12,430	.15	44,020,633	5,174,343	11.8	88,354	.2		
1932.....	7,793,878	38,446	.5	9,307	.12	45,852,422	5,222,420	11.4	83,160	.18		
1933.....	7,554,258	31,971	.42	7,993	.11	45,698,053	4,820,152	10.5	76,449	.17		
1934.....	9,476,141	34,509	.36	9,329	.10	45,773,196	5,102,636	11.1	77,724	.17		
1935.....	12,563,474	30,569	.24	8,273	.07	34,413,317	3,714,828	10.8	52,687	.15		
1936.....	10,215,227	19,076	.19	4,856	.05	28,506,019	2,925,593	10.3	31,584	.11		
1937.....	10,853,778	15,816	.15	4,003	.04	36,226,309	3,435,433	9.4	33,520	.09		
1938.....	9,934,984	11,668	.1	2,828	.03	32,453,905	2,964,201	9.1	26,088	.08		

<sup>1</sup> Held for more complete examination to determine final disposal.

retained, but some loss occurs for the reason that the diseased portions found unfit for food would have a considerable value if healthy.

In animals in which the disease is not extensive enough to cause condemnation of the entire carcass the disease is usually in the early stages. Had the animals been allowed to live for possibly only a short time longer the disease would have progressed until all the carcass would have to be considered diseased. In some animals the lesion of disease has become surrounded by tissue that "locks it up" and prevents it from spreading to other parts of the body. Such a condition, however, is liable to change at any time during the animal's life and allow the disease to enter other parts of the body, and also to be carried out of the body and so endanger healthy cattle and swine.

On the farms from which these animals came, some of the remaining cattle and swine are probably affected with tuberculosis, or will be if allowed to remain there for a sufficient length of time. Knowing this danger, State and Federal officials, when the identity of the animals can be established, trace back as many of the shipments of diseased animals as possible, and through the cooperation of the owner try to exterminate the disease from those farms.

#### CAUSE OF TUBERCULOSIS

The cause of tuberculosis is a rod-shaped germ (*Mycobacterium tuberculosis*) discovered by Robert Koch in 1882. This organism can be seen only with the aid of a microscope of high magnifying power. The presence of this germ in the bodies of human beings or livestock



is absolutely necessary to produce the disease. The germs of tuberculosis may also be grown artificially in proper material at a temperature of about 98° F.

Outside the bodies of animals the organism is not capable of reproducing itself, except as mentioned previously. When exposed to the direct rays of the sun it dies quickly—a fact to be noted in the disinfection of pastures, paddocks, and barn lots. The organism may live for months, however, when it is protected by dry manure and other materials which form a crust over it and prevent its destruction by the sun's rays. It is of extreme importance, therefore, to clean and disinfect thoroughly all barns, stalls, and other enclosures which have contained tuberculous animals, before healthy ones are again placed in them.

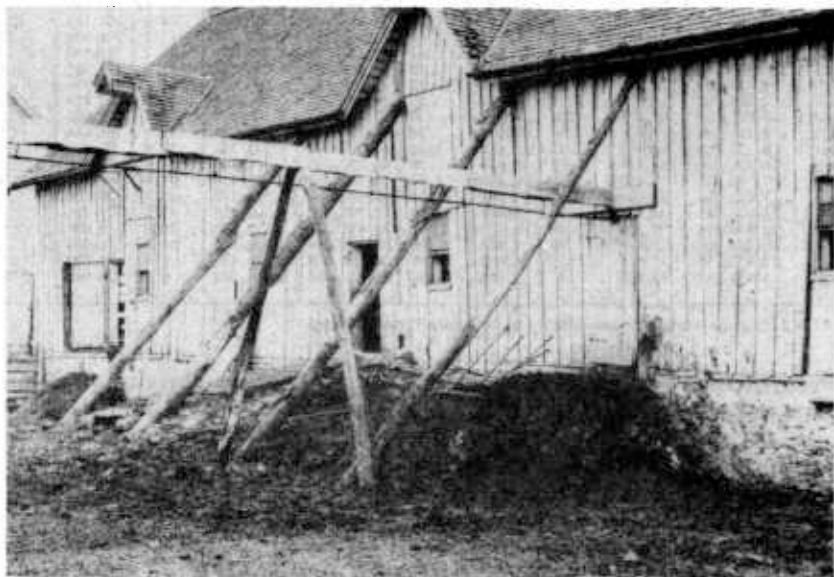


FIGURE 3.—An insanitary barn. Nearly all the cows kept in it were tuberculous. Premises of this character cannot be kept sanitary.

While it is necessary for the germs of tuberculosis to be introduced into the body of the animal before the disease can be produced, there are many conditions or accessory causes which make animals fall victims to tuberculosis.

Animals which are fed on nonnutritious feeds, as well as those that have too little feed, become weakened constitutionally and lose the power to resist the invasion of the organisms. Stabling animals in dark, poorly ventilated, and dirty barns helps to spread tuberculosis among the stock whenever the germs are present (figs. 3 and 4). Introducing a tuberculous animal is almost sure to give the disease to healthy animals in a short time. If the healthy animals drink water from the same trough or bucket that the tuberculous animal uses, and if that animal is coughing up tuberculous sputum, all the animals are in serious danger of infection. Any condition that produces constant strain upon the systems of animals, such as the continued

forced lactation periods of dairy cows, renders them fit subjects for the development of tuberculosis.

#### HOW CATTLE BECOME INFECTED

The tuberculous cow is the greatest source of danger to healthy cattle. Inasmuch as it cannot be determined just when that animal becomes a "spreader" of the germs unless daily microscopic tests are made of the milk and of the discharges from the body, it is unsafe to keep her with healthy cattle. No cattle from outside sources should be introduced into a healthy herd until they have been tuberculin-tested and found free from the disease. Unquestionably more healthy cattle acquire tuberculosis by coming in contact with affected animals than in any other way. It has been observed frequently that cattle which stand on either side of or face tuberculous animals in barns are the first to contract the disease.

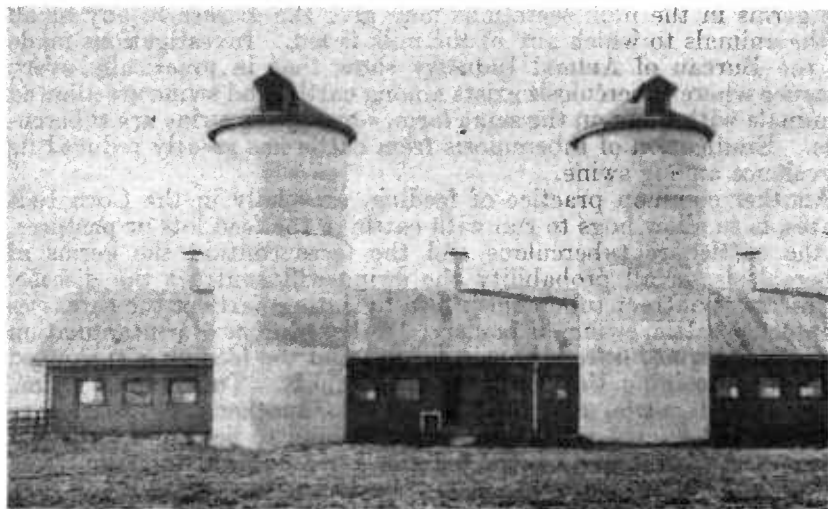


FIGURE 4.—A modern sanitary barn. Note ventilators and liberal window space.

The common water trough, especially in barns, is also the cause, to a very large extent, of spreading the disease. Cattle may become infected by picking over manure infected with the germs of tuberculosis. Hay, straw, or any other feed contaminated with the germs may give the disease to animals that consume such material.

Water holes and creeks into which the infected milk or the washings from infected milk cans have been dumped may also be a source of the infection. The teat siphon or milking tube, in a number of instances, has been the medium by which the disease has been conveyed from one animal to another. Calves contract tuberculosis by nursing, even for a short time, cows whose udders are affected. Calves also become infected by drinking raw milk from diseased cattle isolated from the main herd. To be safe for feed, milk from such cows should first be heated to a temperature of 145° F. and held there for at least 30 minutes, but as this method requires considerable

attention to assure proper heating, boiling for a few minutes is considered a better plan.

#### HOW SWINE BECOME INFECTED

The tuberculous cow is not only a menace to other cattle but is also a source of infection to swine. In some parts of the country, especially where there are whole-milk creameries and skimming stations, feeding mixed skim milk to swine is a common practice. In that way the skim milk from one farm may be fed to hogs on another. Thus it is possible that milk from a few tuberculous cows may set up the infection among swine on many farms.

Milk is a good medium for the distribution of the tubercle bacilli, and swine seem to be extremely susceptible to tuberculosis. Numerous instances are on record also in which the whole milk is separated on the farm, the cream shipped, and the skim milk fed to swine. Consequently one tuberculous animal that is passing the germs in the milk secretions may give the disease to any or all of the animals to which any of the milk is fed. Investigations made by the Bureau of Animal Industry show that in practically every instance where tuberculosis exists among cattle, and swine are allowed to mingle with them on the same farm, some of the swine are tuberculous. Eradication of tuberculosis from cattle has greatly reduced its prevalence among swine.

Another common practice of feeding, especially in the Corn Belt States, is to allow hogs to run with cattle in the feed lots or pastures. If the cattle are tuberculous and the feces contain the germs of tuberculosis, in all probability the swine will contract the disease. Swine may contract tuberculosis also by eating parts of the carcasses of infected cattle, swine, or poultry. Other sources of contamination are infected sputum from human beings, and the feeding of uncooked garbage containing the germs of tuberculosis. Tuberculous swine, like diseased cattle, may also infect one another. Investigations indicate that a large percentage of hogs found to be slightly affected with tuberculosis have contracted the avian type of infection from poultry.<sup>2</sup>

#### SYMPTOMS OF TUBERCULOSIS

It must be understood that tuberculosis is a disease which often gives no indication of its presence by external symptoms (fig. 1). Yet persons skilled and experienced in dealing with the disease among animals frequently are able to detect certain abnormal conditions which lead them to pronounce the animal as probably affected with tuberculosis. A generally run-down condition, accompanied with a cough, is often considered to be an indication of tuberculosis but is not a conclusive symptom. When tuberculosis is suspected it is always advisable to apply the tuberculin test without delay.

As the disease often involves the lymphatic glands in various parts of the body an examination of such glands as can be felt in the living animal is sometimes helpful in diagnosing the disease. The glands of the throat, udder, and point of the shoulder often present an abnormal condition, such as an enlargement or hardening. Cattle affected with tuberculosis in advanced stages often show a "staring" coat and a generally unthrifty condition. When the throat glands of an ani-

<sup>2</sup> Farmers' Bulletin 1652 describes and gives information on fowl tuberculosis.

mal are affected it often holds its head in an abnormal position in order to relieve the pressure which causes difficult breathing. Increased respiration is often noted when the lungs or lymphatic glands of the thoracic cavity are affected. When some of the glands of that cavity are extensively diseased the animal may develop bloat (fig. 5). Diarrhea is evident in some cases in which infection has extended to the abdominal cavity. The symptoms mentioned, though typical, must not always be expected when animals are tuberculous; animals that are extensively diseased are often in apparently perfect physical condition.

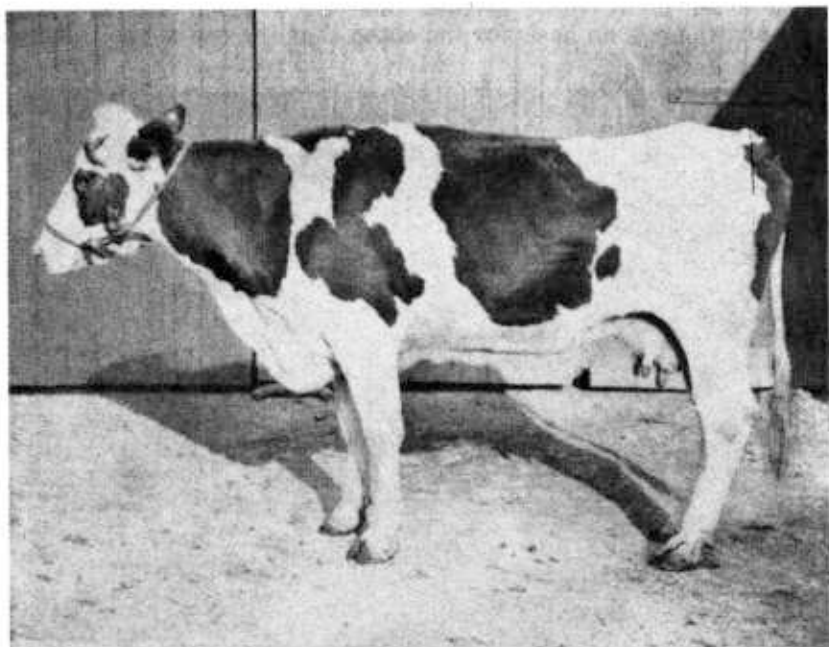


FIGURE 5.—A reacting cow that was constantly bloating. The pressure of greatly enlarged tuberculous glands on the gullet was the cause of the bloating.

#### METHODS OF DIAGNOSIS

Microscopic examinations of the sputum, milk, and bowel discharges of an animal are sometimes made to determine the presence of tubercle bacilli and to diagnose tuberculosis, but after many years of experience the tuberculin test is now considered to be the most practicable and satisfactory way of diagnosing the disease in the living animal. The inoculation of guinea pigs with emulsions made from milk or discharges from the living animals is sometimes resorted to as a means of diagnosis, but that method of examination is technical and requires special scientific training and equipment. Besides, cases of tuberculosis may be overlooked when laboratory methods are used, because tuberculous animals do not always discharge the tubercle bacilli.

## THE TUBERCULIN TEST

Testing animals with tuberculin is the process of introducing tuberculin into the animal and interpreting results according to well-known standards. Tuberculin is a laboratory product prepared scientifically and, when of standard potency and used by skillful veterinarians, it is a reliable agent for detecting tuberculosis in animals. Tuberculin contains no tubercle bacilli but is a product of the growth of the germs, properly mixed with a substance on which it has grown and then properly diluted and preserved. No harm can result to healthy animals from the proper application of tuberculin even if doses many times greater than the regular ones are used. Moreover, there is no basis for the claim that the use of the tubercu-

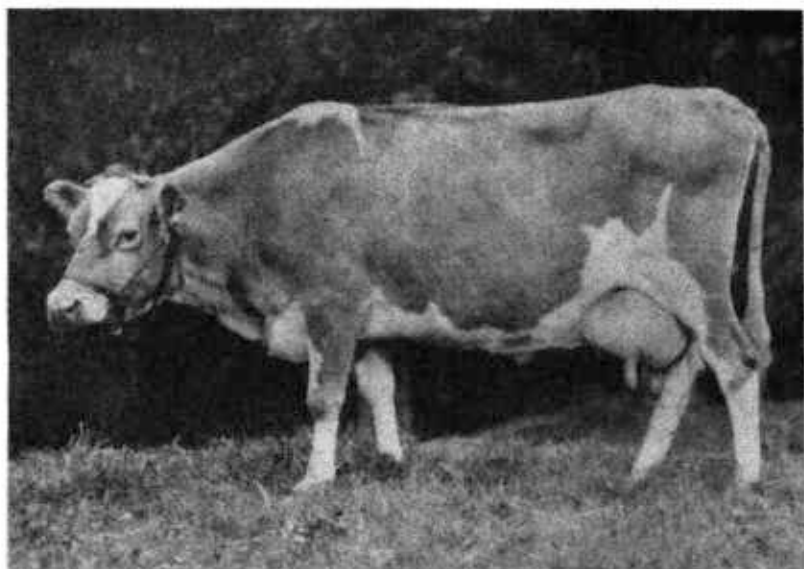


FIGURE 6.—A purebred Guernsey cow that produced 5 sons and 10 daughters, 6 of which made advanced-registry records. She lived until nearly 22 years old, receiving the tuberculin test annually, but showed no reaction or ill effects from the tests. One of her granddaughters made two advanced-registry records and sold at auction for \$3,000.

lin test will in any way affect a cow's ability to produce. There are thousands of high producers that are given the tuberculin test annually (fig. 6).

The use of tuberculin by untrained persons is to be discouraged for the reason that in many cases its effect on tuberculous animals is unobserved and not understood by those unfamiliar with its action. Tuberculin, by its immunizing property, can cause tuberculous animals to fail to respond to a second application made within a short time; therefore it may be misused by unscrupulous persons.

## THE INTRADERMIC TEST (INTO THE SKIN)

The intradermic, also known as the intracutaneous, test for detecting tuberculosis is used extensively. When made by those who have become skilled in its application it is very accurate. In this test the

tuberculin is injected between the layers of the skin, and it is usually applied in the region at the base of the tail, where the skin is soft and nearly hairless. The intradermic test is satisfactory also for the diagnosis of tuberculosis in swine, and when so used the tuberculin is applied in the skin of the ear near its base.

The reaction from the intradermic test consists of a swelling at the point of injection and is usually observed from 72 to 120 hours after the injection. The character of the swelling varies, and a proper diagnosis of tuberculosis by this test can be made only by an experienced veterinarian.

#### THE OPHTHALMIC TEST (OR EYE TEST)

Still another method, known as the ophthalmic, is used to some extent and has been found to be of considerable value in what is known as "check" testing; that is, it is used in connection with either of the other two methods here described. Sometimes a tuberculous animal that fails to react to those tests shows evidence of the disease upon the application of the ophthalmic test. The ophthalmic tuberculin is placed in one eye and the other eye is used as a check. A reaction is indicated by a characteristic discharge from the eye receiving the treatment, which may occur in from 3 to 10 hours after the application or even later. Some swelling and inflammation of the eye and lids are often noted.

The ophthalmic test has given best results under farm conditions or in other cases where the eyes are normal. For testing cattle in transit or in the stockyard the test is less dependable, owing to the fact that the eyes may be abnormal as the result of irritation or injury from dust, cinders, or other results of transit.

In all cases the tests, used either alone or in combination, should be applied by capable veterinarians familiar with tuberculin testing.

#### THE SUBCUTANEOUS TEST (UNDER THE SKIN)

The subcutaneous test is made by injecting the proper quantity of tuberculin underneath the skin into the subcutaneous tissue. If an animal is tuberculous, the action of the tuberculin causes a fever, which is indicated by a rise in temperature. This rise, under ordinary conditions, may occur any time between the eighth and twentieth hours after the tuberculin is injected, but in some cases it is desirable to take the temperature before the eighth hour and continue to the twenty-fourth hour or longer.

The temperatures are taken at least three times in advance of the injection, at 2-hour intervals, to learn whether the animal is in proper condition to receive the test. The temperatures after injection are taken every 2 hours until the test is completed. The proper interpretation of the temperatures is made by the veterinarian who applies the test, and a careful observance of any clinical changes is always important in determining the result. It cannot be set forth too strongly that all forms of the tuberculin test should be attempted only by those who are properly qualified to do the work.

#### POST-MORTEM APPEARANCES

Animals affected with tuberculosis may show the effects of the disease in almost any part of the body. In advanced cases the lesions are easily found, but when the disease is of recent origin or

if a slightly diseased area has been encapsulated or closed up, it is often very difficult to find evidence of the disease. Lesions in advanced cases generally appear as nodules or lumps, which are tubercles formed as a result of the disease. These lumps may be found in great numbers in the lungs and abdominal organs (figs. 7 and 8). The lesions are of various sizes and may contain pus, either soft or hard. Frequently the pus is gritty, especially in swine. Tubercles are often found in various numbers attached to the walls of the thoracic and abdominal cavities (fig. 9). Lesions of the disease also occur in the lungs, liver, and spleen. The lymph glands are usually affected to some extent, and, when cut into, show diseased areas characteristic of tuberculosis.



FIGURE 7.—Part of a tuberculous udder showing well-developed lesions.

Lesions of the disease may be found also in the skin and in or on the bones. In animals only slightly diseased, the lesion may be hidden so that it is impossible even for a person skilled in post-mortem work to find it. A microscopic examination of the lymphatic glands or other tissues often reveals the presence of tubercle bacilli when no lesions can be seen by the naked eye, a condition showing that the disease is just starting. When animals have reacted to the tuberculin test, a very careful post-mortem examination should be made. The action of tuberculin is often discredited when on post-mortem the lesions are not plainly seen, but experience of many years has shown that very few animals that reacted to the test were not affected with tuberculosis to some extent, even though some of the reactions were very slight.<sup>3</sup>

#### ERADICATION PROJECTS

Four main projects comprise the general campaign of eradication:

- (1) Eradication of tuberculosis from purebred or other individual herds of cattle.
- (2) Eradication of tuberculosis from cattle in circumscribed areas.
- (3) Eradication of tuberculosis from swine.
- (4) Eradication of tuberculosis from poultry.

#### ACCREDITED-HERD OR HONOR-ROLL PLAN

The accredited-herd or honor-roll plan applies to individual herds. Herds found to be free from tuberculosis on two successive annual tests (fig. 10) are placed on the honor roll, and a certificate is given to the owner by the State and the Federal Government. The certificate entitles animals of that herd to be shipped interstate without further tuberculin testing for a period of 1 year. This plan has become well known to breeders throughout the United States.

<sup>3</sup> For further information on this subject, see Miscellaneous Publication No. 59, Reliability of the Tuberculin Test.

The methods of eradicating tuberculosis from grade herds are, of course, the same as for purebreds. No owner can rest assured that his herd is free from tuberculosis unless it has been properly tuberculin tested. Careful physical examination of each animal should be made before or during the application of the test. If animals react to the test they must be separated from the rest of the herd.

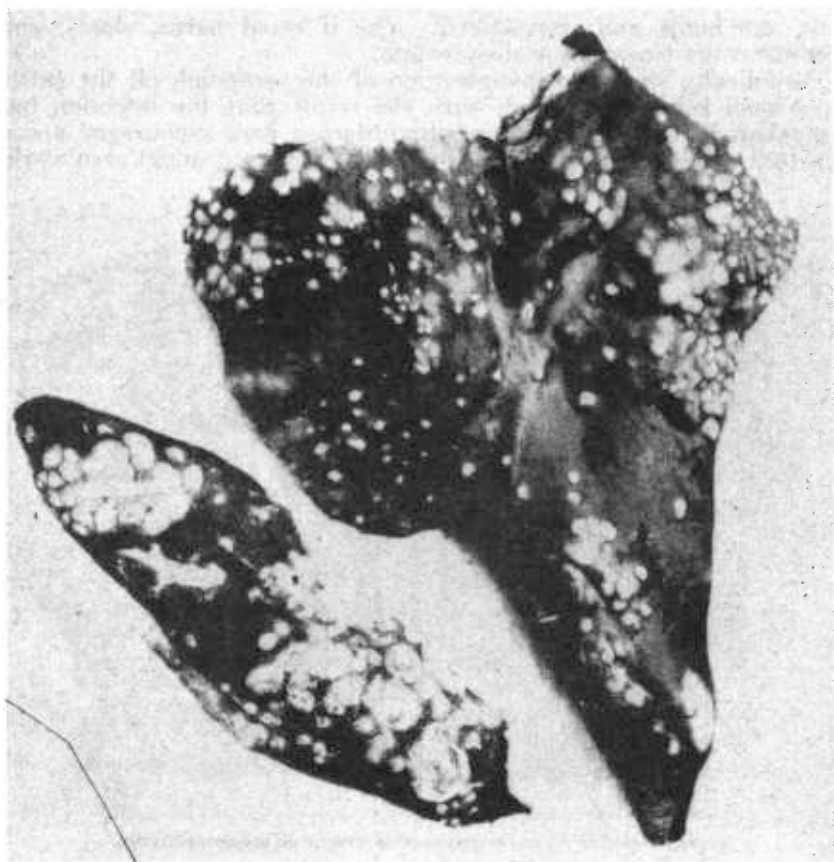


FIGURE 8.—Liver and spleen showing extensive lesions of tuberculosis.

#### ERADICATION FROM CATTLE IN CIRCUMSCRIBED AREAS

As a general rule, it is best to take up the work by counties, and substantial cooperation should be obtained from the county government. Each county may pay (1) part of the expense of exterminating the disease by employing inspectors to make the tests, (2) part of the indemnities paid for tuberculous animals, and (3) its share of the cost of cleaning and disinfecting infected barns, stables, and sheds. When a large percentage of the herds of a county are diseased, it may be advisable to clean up the herds within a township or possibly one third or one half of the area. The progress depends



upon the degree of infection found and the cooperation furnished by the owners.

In 1910 the Bureau of Animal Industry took up the eradication of tuberculosis from the herds in the District of Columbia, which has an area of about 60 square miles. At that time 1,701 cattle were found. Every animal was tuberculin-tested; of the total number, 321 cattle, or 18.9 percent, were tuberculous. The reactors were removed from the herds and slaughtered. The infected barns, sheds, and premises were cleaned and disinfected.

Periodically since the inauguration of the campaign all the cattle have been tuberculin-tested, with the result that the infection has disappeared. The favorable results obtained here encouraged many livestock owners and State and Federal officials to conduct area work.

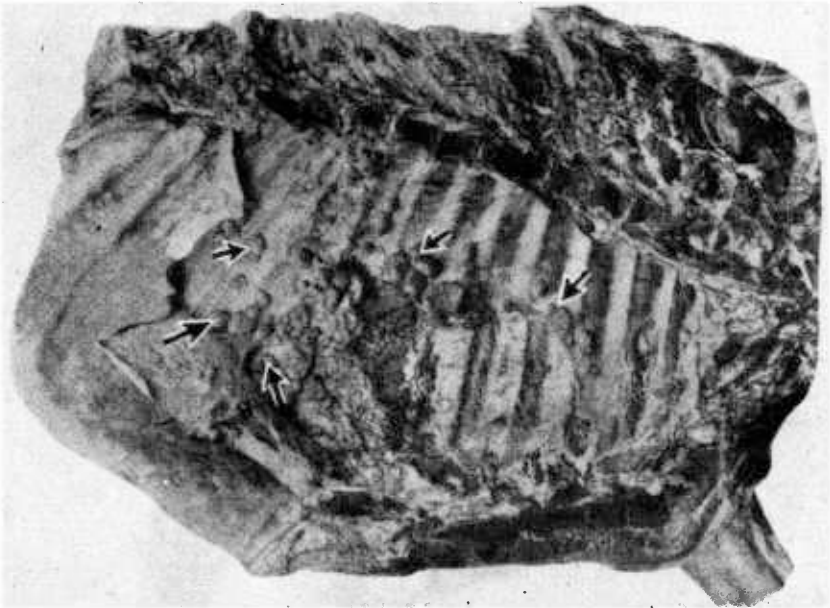


FIGURE 9.—Portion of a beef carcass showing tuberculous nodules on the ribs.

The plan of carrying on eradication under the area plan is practicable and is being conducted in all States.

Before undertaking the work in any area, large or small, the cattle owners should be consulted, and unless they are willing to lend their earnest cooperation and know the sacrifice they may have to make it is inadvisable to start. The better the organization and the more nearly perfect the plans are made, the more efficiently the work should progress.

The intradermic method should be used, as faster progress can be made with it than with the subcutaneous test. If reactors are found in using the intradermic test, the entire herd should be tested again within from 60 to 90 days.

When less than one-half of 1 percent of the cattle in a given area, usually a county, are found to be affected with tuberculosis, such area

is declared to be a modified accredited area. Cattle from such areas may be moved interstate without further tuberculin test, so far as Federal requirements are concerned. The first counties were accredited in July 1923 and 3,142 counties had been accredited up to April 1, 1939. This number includes all municipalities in Puerto Rico and the Virgin Islands.

#### ERADICATION FROM SWINE

With the gradual elimination of tuberculosis from cattle and also from poultry, the prevalence of the disease among swine tends to diminish. It is not necessary to apply the tuberculin test to all the swine herds because it is more economical to send the entire herd, with the exception of valuable breeding animals, to market when fat than to undertake to exterminate the disease in any other way.



FIGURE 10.—Part of an accredited Holstein-Friesian herd in Virginia. This herd has been free of tuberculosis since 1923.

In case valuable purebred swine are suspected of having tuberculosis they should be tested by the intradermic method. As in the case of cattle, diseased swine should be removed from the farm, and the sheds, farrowing houses, and the lots should be thoroughly cleaned and disinfected.

#### ERADICATION FROM POULTRY

Tuberculosis in poultry is caused by a different type of the tubercle bacillus, known as the avian type. The disease is very prevalent in the Central and North Central States. In some sections of this area from 50 to 75 percent of the poultry flocks are affected with this disease. Swine are very susceptible to avian tuberculosis, and this fact increases the importance of controlling and eradicating this type of tuberculosis. The disease can be placed under control, and eventually

eradicated, by following approved methods of sanitation and poultry husbandry.<sup>4</sup>

### PROGRESS OF ERADICATION

The campaign for the systematic eradication of tuberculosis from livestock met with increasing favor as the work progressed. Table 2 shows the progress made since the early stage of the campaign. Records of the Bureau of Animal Industry indicate that during recent years the testing has progressed at the rate of more than a million cattle a month.

TABLE 2.—*Progress of tuberculosis-eradication work in cooperation with States, 1917-38*

Fiscal year	Herds tested	Cattle tested	Reactors found		Fiscal year	Herds tested	Cattle tested	Reactors found	
			Num-ber	Per-cent				Num-ber	Per-cent
1917.....		20, 101	645	3. 2	1928.....	1, 048, 277	11, 281, 490	262, 113	2. 3
1918.....		134, 143	6, 544	4. 9	1929.....	1, 030, 679	11, 683, 720	206, 764	1. 8
1919.....		329, 878	13, 528	4. 1	1930.....	1, 102, 423	12, 845, 871	216, 932	1. 7
1920.....	40, 348	700, 670	28, 709	4. 1	1931.....	1, 162, 414	13, 782, 273	203, 778	1. 5
1921.....	86, 687	1, 366, 358	53, 768	3. 9	1932.....	1, 139, 119	13, 443, 557	254, 785	1. 9
1922.....	195, 220	2, 384, 236	82, 569	3. 5	1933.....	1, 110, 306	13, 073, 894	255, 096	2. 0
1923.....	296, 138	3, 460, 849	113, 844	3. 3	1934.....	1, 283, 914	15, 119, 763	232, 368	1. 5
1924.....	455, 034	5, 312, 364	171, 559	3. 2	1935.....	2, 378, 668	25, 237, 532	376, 623	1. 5
1925.....	607, 345	7, 000, 028	214, 491	3. 1	1936.....	1, 944, 624	22, 918, 038	165, 496	. 7
1926.....	774, 728	8, 650, 780	323, 084	3. 7	1937.....	961, 109	13, 750, 308	94, 104	. 7
1927.....	871, 761	9, 700, 176	285, 361	2. 9	1938.....	1, 007, 586	14, 108, 871	89, 359	. 6

### MEASURES OF PREVENTION

Since, after many years of study and experience, no satisfactory cure for tuberculosis among animals has been found, prevention of the disease is extremely important. State and Federal Governments have made vigorous efforts to stop the spread of the disease by regulating the movements of cattle, and with that object in view, action has been taken in some localities to regulate the movement of cattle from one county to another. Regulation of intercounty movement should be encouraged because it brings the matter nearer home to the livestock owner. If each livestock owner takes an active part all through the campaign of tuberculosis eradication, and if he is in favor of measures to prevent the spread of the disease and faithfully abides by those measures, eradication will be accomplished more speedily.

From what has been said already about the dangers of shipping diseased cattle, it is plain that the movement of tuberculous cattle, except for immediate slaughter or to quarantine, must be stopped whenever possible. After diseased animals are found and removed from the premises, a very thorough cleaning and washing of the inside of the barn and other buildings where the animals have been should be made. This must be followed by the proper application of some approved disinfectant.<sup>5</sup> Using disinfectants without first doing the

<sup>4</sup> Further information regarding avian tuberculosis may be obtained in Leaflet 102, Eradicating Tuberculosis from Poultry and Swine.

<sup>5</sup> Farmers' Bulletin 954, The Disinfection of Stables, gives further information concerning the use of disinfectants for premises.

necessary and proper cleaning is ineffective, as the germs of the disease must be exposed. All utensils or anything else that may have become contaminated by use around the diseased animals should likewise be cleaned and disinfected. The manure and refuse must be hauled from barnyards or lots to plowed fields, spread thin, and exposed to the sunlight. The yards and lots, including feed troughs, water troughs, and fences, can then be sprayed properly with the disinfectant.

All this means much work, but it must be done to prevent infection from spreading to the healthy animals. Proper sanitary conditions on premises where livestock are kept is of great importance in keeping the animals healthy and able to resist disease. Sanitation, in its broad sense, includes the admission of abundant sunlight and fresh air properly regulated.

#### MARKING ANIMALS FOR IDENTIFICATION

It is very important to mark properly all cattle which react to the tuberculin test, so that they may be easily identified. Reactors are branded on the left lower jaw with a letter T about 2 inches high. In addition to the branding, the reacting animals should be properly tagged so that each one may be positively identified, and in that way the results of the post-mortem examination can be connected up with the reporting of the tuberculin tests. The tag is placed in the left ear of the animal and contains a serial number as well as the word "Reactor."

Cattle that have passed the tuberculin test are marked by a numbered metal ear tag which is placed in the right ear. It is not often necessary to require special marks on purebred registered cattle, as the owner usually has a method of identification, and this method of marking can be used in connection with the tuberculin test as a record; but on grade animals it is desirable to use some system of marking to show that the cattle have been tested and found apparently free from tuberculosis.

A system of marking swine to show the origin of those found to be tuberculous on post-mortem examination consists in tattooing a number or mark of identification into the skin of the hog. The method is fully described in Miscellaneous Circular 57, *The Tattoo Method of Marking Hogs and Its Use*.

Many shipments which contain tuberculous swine are traced back to the originating farm by a system of reports kept by the Bureau of Animal Industry. By developing the methods of tracing tuberculous cattle and swine from the abattoir back to the farm where they were raised, efforts can be directed toward eradicating the disease from these herds.

#### APPRAISEMENT AND INDEMNITY

In addition to the various benefits derived from eradicating tuberculosis from cattle, provision for partial compensation for those that are condemned is a further incentive. The laws of 45 States and of the Territories of Alaska, Hawaii, and Puerto Rico provide for a payment for condemned tuberculous cattle, and the Federal Government also bears a share of the expense under certain conditions. The

legislation regarding payment of indemnity for tuberculous cattle varies somewhat in different States, and the amount paid by the Federal Government depends somewhat upon the action taken by the State or Territory. Therefore, for detailed and current information on the subject the reader is referred to his State livestock sanitary officials or to the inspector in charge representing the Bureau of Animal Industry in cooperative tuberculosis-eradication work. The names and addresses of these officials may be obtained from the Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.

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